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7. Abstract

This plan discusses the sampling points, materials and wastes sampled, sampling methods, and sampling and analytical requirements for samples generated at the Grout Treatment Facility.

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# GROUT SAMPLING PLAN

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December, 1991

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# GROUT SAMPLING PLAN

## 1.0 PURPOSE

The following document details the sampling plan for the materials used and wastes generated in the site-specific grout process.

## 1.1 BACKGROUND

The grout process solidifies low level radioactive liquid wastes stored in the Hanford site Tank Farms. Four systems/facilities comprise the Grout Treatment Facility (GTF): (1) the Feed Transfer System (FTS), which delivers the wastes from Tank Farms to the process; (2) the Dry Materials Facility (DMF), where selected dry materials are stored in bins and blended in a specific ratio for use in the process; (3) the Grout Processing Facility (GPF) where the waste and blended dry material are mixed to form a slurry; and (4) the Grout Disposal Facility (GDF), where the slurry received from the GPF solidifies in subgrade vaults.

## 1.2 USAGE OF TERMS

Completeness - Completeness is a qualitative measurement of how valid a piece of data is. The quality assurance objective for completeness of chemical analyses in the 222-S laboratory is 90%. 100 percent completeness is required in this plan for some analyses.

Essential Material- Essential materials are chemicals and materials used or consumed in plant processes and considered essential to the continuity of operations. Essential materials purchased offsite (with the exception of the dry materials) are sampled upon receipt by procurement. Procedure GA-2.15 of WHC-CM-5-5 (WHC 1991a) discusses Essential Materials.

Required sampling points - Required sampling points are points in the process where a sample must be taken at a prescribed frequency or under specified conditions.

Optional sampling points - Optional sampling points are available for sampling when additional information is desired. Optional sampling will be specified by the Process Engineering. Several examples are listed here for further clarification:

(1) Analysis of dry blend at required sampling point B-1 shows that the material is out of specification. Sampling at optional points B-2, B-3, B-4, B-5, B-6, B-7, and B-8 could be requested to show that the material blended since the last tested batch is acceptable.

(2) A caustic/nitrite solution (mixed and sampled at another facility) is added to the partially filled caustic/nitrite tank. The material might be sampled at sample point D-2 to verify that the contents of the tank are well established.

(3) A tank was filled with nonradioactive grout during acceptance/operability testing of the Grout Processing Facility. The tank was later sampled to characterize the tank and optimize sampling techniques. Sample identifier G-X for a nonroutine sample was used (Section 4.20).

Grab Sample - A sample obtained in a single operation.

Composite Sample - A sample obtained over an interval of time or by combining three or more grab samples.

Equivalence- As used in this document, equivalence refers to the utilization of Fourier Transform Infrared spectrometry (FTIR) in place of other accepted analytical techniques for dry materials analysis (e.g. wet chemical methods). Equivalence must be demonstrated by extensive testing of identical materials. FTIR is attractive due to the short turnaround times and excellent reproducibility of results.

## 2.0 SCOPE

This plan addresses the sampling of the dry materials, waste feed, additives, grout product, leachate, emissions, excess vault liquid, decontamination wastes, and groundwater wells associated with the grout process.

The sampling plan describes each sampling point in the grout process. Sampled materials, sampling methods, requirements and bases, and analysis of material are discussed for each point. The required sampling points are illustrated in Figure 1. Figure 2 represents both required and optional sampling points for the complete grout process.

Appendix 1 lists the pertinent sample collection and shipment information. Laboratory turnaround times for process samples are also listed in Appendix 1. Dry materials samples and liquid waste samples are considered process samples.

Appendix 2 lists sample information useful to the laboratory (analysis, analytical method, minimum or maximum concentration required, etc).

Sampling of candidate tanks (for acceptability for grout processing) is not discussed in this document. Generally, a test plan is written by Grout Technology for candidate tank sampling.

Construction-related sampling (e.g. of vault materials) is specified and controlled by Kaiser Engineers Hanford (KEH) and is outside the scope of this document.

Groundwater sampling is discussed in Section 4.33 of this document. However, site baseline and characterization (soil and groundwater) sampling is managed by WHC's Environmental Division. This discussion of groundwater sampling is for information only.

Vault and GPF mixer module exhaust sampling is performed by Health Physics personnel using procedures in the *Health Physics Procedures Manual* (WHC-IP-0692, WHC 1991b). The discussion in Sections 4.25 and 4.26 is for information only.

## 3.0 SAMPLING SAFETY AND QUALITY CONTROL

### 3.1 SAMPLING SAFETY

The operating procedures will address the necessary industrial and radiological safety precautions and will specify the hazardous material handling protocol when necessary. Material Safety Data Sheets will be kept at the appropriate facility.

Hazard communication procedures have been drafted and will be added to WHC-CM-5-40, Grout Operations Administration (WHC 1991c), upon approval.

### 3.2 QUALITY CONTROL

Quality control measures consist of the Laboratory Customer Communication System (LCCS), Laboratory Measurement Control System (LMCS), quality records maintenance, and chain of custody requirements.

The LCCS assigns sample numbers and allows access to analytical results once the results have been reviewed by the lab. The LMCS lists the results on standards run for each analytical procedure. The analytical procedures cannot be used if the analyses of standards are inaccurate.

Data sheets and other sampling documentation for dry materials, waste feed, and grout product shall be considered permanent quality records (records must be maintained for the life of the facility). If sample results do not meet established specifications, the responsible organization will address the issue.

Westinghouse Hanford Company must be able to provide the chain of possession and custody of any samples which are offered for evidence of which form the basis of analytical test results introduced as evidence. Written procedures must be available and followed whenever evidence samples are collected, transferred, stored, analyzed or destroyed. The primary objective of these procedures is to create an accurate written record which can be used to trace the possession and handling of the sample from the moment of its collection through the analysis and its introduction as evidence. A sample is in someone's "custody" if:

1. It is in one's actual possession, or
2. It is in one's view, after being in one's physical possession, or
3. It is in one's physical possession and then locked up so that no one can tamper with it, or
4. It is kept in a secured area, restricted to authorized personnel only.

When transferring the samples, the transferee must sign and record the date and time on the chain of custody record. Custody transfers made to a sample custodian in the field should account for each sample, although samples may be transferred as a group. Every person who takes custody must fill in the appropriate section of the chain of custody record. The number of custodians should be minimized to keep custody records to a minimum.

Full chain of custody requirements are specified for those samples which have regulatory significance. Samples deemed to have regulatory significance are waste feed samples (Section 4.19), grout product samples (Section 4.23), air emissions (Sections 4.25 and 4.26) and groundwater samples (Section 4.33).

The organization performing the sampling is responsible for implementing chain of custody procedures. All packages sent to the lab must be accompanied by the chain of custody record and other pertinent forms. A copy of these forms should be retained by the originating office.

## 4.0 SAMPLE POINTS

Each Grout Facility sampling point is discussed below.

### 4.1.0 SAMPLE POINT E1-A -- RAIL CAR DELIVERY

This sample point is located at the receipt inspection station for the Dry Materials Facility (DMF). The samples from this point are obtained from the sample ports on the top of the railroad cars delivering dry materials to the DMF. The essential dry materials for processing double-shell tank (DST) wastes will be determined prior to each grout processing run. The samples obtained from this sample point are used to verify that dry materials received at the DMF meet Essential Material Specifications (EMS), and thus are suitable for use in the grout process.

### 4.1.1 Sampled Materials

All essential dry materials arriving by railcar will be sampled at this point. The formulation materials to be used will be determined prior to each run, but may include the following:

- Cement
- Flyash
- Blast furnace slag
- Attapulgite clay

Other materials will be sampled if chosen to be included in the dry blend formulation.

### 4.1.2 Sampling Methods

The materials are extracted using a thief grab sampler in accordance with Westinghouse Hanford Company procedure ESP-G-080-00107. Thief sampling is discussed in ASTM E 300-86. A thief sampler consists of two slotted concentric tubes usually made of stainless steel or brass. The outer tube has a conical point that permits the sampler to penetrate the material being sampled. The inner tube is rotated to open and close the sampler. The thief is used to sample the material by inserting the sampler into the dry material, rotating the inner tube to open the sampler, closing the sampler, and removing the sampler from the material. The thief sampler retrieves approximately 4 ozs. of material.

### 4.1.3 Sampling Requirements and Bases

Each shipment of dry materials must be sampled and tested prior to acceptance and unloading into the appropriate bin. Every hatch of every railcar will be sampled. The individual 4 oz. samples will be composited so that one sample per railcar is sent to the lab for acceptance testing.

The data from the analysis of the dry material must be available before transfer of the dry material into the DMF bins. One hundred percent completion of all analyses is required for acceptability testing. The basis for testing each railcar is that each railcar of dry material represents one lot of material and the acceptability of each lot of material must be verified by Process Engineering before it is transferred into the DMF. This verification is required to ensure that all dry materials used for grout processing meet Essential Material Specifications.

### 4.1.4 Analysis of Dry Materials

Analysis of the dry materials provides the data required for verifying compliance with purchase specifications and ensures that any material received is suitable for use. The following materials will be analyzed:

- Cement
- Class F flyash
- Blast furnace slag
- Attapulgite clay

Other materials will also be tested if chosen to be included in the dry blend formulation for grout processing.

Before each campaign, the suppliers for each dry material to be used in the grout formulation will provide a representative sample of their product. These samples will be analyzed to determine if they meet the product specifications. After the representative samples have been well qualified and accepted, subsequent samples taken during the campaign are compared to the representative samples using a Fourier transform infrared-attenuated total reflectance (FTIR-ATR) analyzer. The FTIR technique is used to provide rapid confirmation of sample quality since the turn-around time for wet-chemical analyses (several months) would unduly delay acceptance of shipments.

The cement received at the dry materials facility is analyzed to determine if it meets the specifications of ASTM C-150-89 (ASTM, 1990) for type I/II cement. This determination requires that the following characteristics of the cement be determined:

- Blaine fineness
- False set characteristics
- Final penetration
- Loss on ignition
- Aluminum oxide content
- Tricalcium aluminate content
- Ferric oxide content
- Silicone dioxide content
- Sulfur trioxide content
- Magnesium oxide content
- Insoluble residue

Additional requirements for Blaine fineness, false set/final penetration, and tricalcium aluminate plus tricalcium silicate content are listed in Appendix 2.

Cement samples are compared with reference cements from the National Institute of Standards and Technology (NIST). This is performed using an FTIR-ATR analyzer. Spectral subtraction or a partial least squares algorithm may be applied for silicate and aluminate content. Values obtained by this technique can be compared to those calculated by X-ray fluorescence technique (two days turnaround time) or wet chemical methods (several months turnaround) per ASTM C-150-89 (ASTM, 1990). The analysis of the sample must be within 5% of the reference material for the load to be accepted.

The flyash received at the dry materials facility is analyzed to determine if it meets the specifications of ASTM C 618-89 (ASTM, 1989) for Class F flyash. The following properties of the flyash must be verified:

- Loss on ignition
- Aluminum oxide content
- Iron oxide content
- Silicone dioxide content
- Sulfur trioxide content
- Moisture content
- Fineness

These characteristics are determined by wet-chemical, X-ray fluorescence and chemical and physical analyses performed on a representative sample. Subsequent samples are compared to the representative sample using FTIR. The spectra of the sample must be within 5% of the reference material (by spectral subtraction) to be accepted.

The blast furnace slag received at the dry materials facility is analyzed to determine the following:

- Calcium oxide content
- Silicon dioxide content

These characteristics are determined by wet-chemical or X-ray fluorescence analysis performed on a representative sample. Subsequent samples are compared to the representative sample using FTIR. The spectra of the sample must be within 5% of the reference material (by spectral subtraction) to be accepted.

The attapulgite clay received at the DMF is analyzed by FTIR. These samples are compared for equivalence with well characterized samples which have been tested for viscosity, wet screen analysis, and moisture content. The spectra of the sample must be within 5% of the reference material (by spectral subtraction) to be accepted for offloading into the appropriate DMF bin.

Other dry materials received at the dry materials facility will be analyzed to determine they meet the appropriate Essential Material Specification prior to acceptance.

### 4.2.0 SAMPLE POINT U1-A -- RAIL CAR DELIVERY

This sample point is located at the railroad cars delivering dry materials to the receipt inspection station of the DMF. Samples can be taken as the materials are being pneumatically conveyed into the storage bins. This is an optional sampling point.

#### 4.2.1 Sampled Materials

The materials which could be sampled here are listed in Section 4.1.1.

#### 4.2.2 Sampling Methods

In contrast to sample point E1-A, the materials sampled at this point are extracted using an automated system per operating procedure TO-390-055. Incoming railcars are sampled with an automated sampler which is on the discharge side of the receiving pump. This sampler is operated pneumatically from the AC-3 compressed air system.

#### 4.2.3 Sampling Requirements and Bases

There is no requirement to sample at this optional sampling point.

#### 4.2.4 Analysis of Dry Materials

The samples will be analyzed by FTIR as described in Section 4.1.4.

### 4.3.0 SAMPLE POINT E1-B -- TRUCK DELIVERY

This sample point is located at the receipt inspection station for the DMF. The samples from this sample point are obtained from the sample ports on the truck. The materials sampled and the purpose of sampling at this sampling point are the same as at sample point E1-A (Section 4.1.0).

#### 4.3.1 Sampled Material

All essential dry materials arriving by truck will be sampled at this point. The materials to be used will be determined prior to each run, but may include the following:

- Cement
- Class F flyash
- Blast furnace slag
- Attapulgite clay.

Other materials may also be sampled if chosen to be included in the dry material formulation for grout processing.

#### 4.3.2 Sampling Methods

The materials sampled at this sample point are sampled using a thief grab sampler using sampling Westinghouse Hanford procedure ESP-G-080-00107. The sampling method at this sampling point is the same as at sample point E1-A (Section 4.1.2).

#### 4.3.3 Sampling Requirements and Bases

The sampling requirements and bases for dry materials received at the DMF at this sampling point are the same as sample point E1-A (Section 4.1.3).

#### 4.3.4 Analysis of Dry Materials

Analysis of the dry materials sampled at this point will be the same as that described for sampling point E1-A (Section 4.1.4).

## 4.4.0 SAMPLE POINT U1-B -- TRUCK DELIVERY

This sample point is located at the trucks delivering dry materials to the receipt inspection station of the DMF. A hose connects the truck and the automated sampler. A second hose connects the sampler and the appropriate bin fill line. Sampling is initiated by pressing a button on the DMF control panel. The samples are removed and analyzed to verify that dry materials received at the DMF meet specifications for use in the grout process. This is an optional sampling point.

### 4.4.1 Sampled Materials
The materials to be sampled are the same as those for sample E1-A (Section 4.1.1).

### 4.4.2 Sampling Methods
The materials sampled at this point are sampled using an automated system. Incoming trucks can be sampled with an automated sampler. Hoses are connected between the truck and sampler and between the sampler and bin fill line. This sampler is operated pneumatically from an air compressor.

### 4.4.3 Sampling Requirements and Bases
There is no requirement to sample at this optional sampling point.

### 4.4.4 Analysis of Dry Materials
Analysis of the dry materials sampled at this point will be the same as described for sampling point E1-A (Section 4.1.4).



## 4.5.0 SAMPLE POINTS U-1, U-2, U-3, and U-4 -- BINS 2402 EB, 2402 EC, 2402 ED, AND 2402 EF

These sample points are located at storage bins 2402 EB, 2402 EC, 2402 ED, and 2402 EF, which are the individual dry material storage bins at the DMF. The samples of dry material are obtained directly from the bins. Individual shipments of dry material are sampled prior to acceptance and tests are conducted to verify that they meets purchase specifications prior to transfer into the storage bins. However, additional grab samples may be removed and tested at these points when considered necessary. This is an optional sampling point.

### 4.5.1 Sampled Materials
The bin materials will be the same as those listed for sample E1-A (Section 4.1.1).

### 4.5.2 Sampling Methods
The dry material sampled at this point are extracted using a scoop sampler. Scoop samples are extracted using procedure TO-390-025. Scoop sampling is discussed in

ASTM E 300-86 (ASTM 1990).

### 4.5.3 Sampling Requirements and Bases

This is an optional sample point. There is no requirement to sample at this optional sampling point. Sampling is performed at the request of Process Engineering.

### 4.5.4 Analysis of Dry Materials

Analyses which could be conducted on the dry materials sampled at this point are the same as described for sampling point E1-A (Section 4.1.4).

## 4.6.0 SAMPLE POINT B-1 -- BLEND IN BLENDER AT DRY MATERIALS FACILITY

The dry materials are blended in batches according to the required formulation. The blended batch size and proportions of each of the constituents are controlled and monitored by a programmable controller and load cells under the batch pump. The preferred batch size is 5000 lb, as it provides the best formulation accuracy. Batches are tested periodically to verify that the blend ratio is within specifications. The blender discharges into the blended material storage bin.

### 4.6.1 Sampled Materials

A sample of the blended dry materials is removed from the blender for analysis.

### 4.6.2 Sampling Methods

The material removed from the blender is sampled using an automated sampler. Sampling is initiated at the DMF control panel. Operating procedure TO-390-035 is followed to sample to blend.

### 4.6.3 Sampling Requirements and Bases

The required sampling frequency is one sample per 20 batches, based on ASTM C 311-90 (ASTM, 1990). The minimum sample size is 1/2 lb (ASTM C 311-90 calls for a 4 lb. sample for every 400 tons of material. Sampling 1/2 lb. every 100,000 lbs. is a more stringent requirement because the material is sampled more often).

The basis for this requirement is that the batch must be confirmed for compliance with the blend specifications prior to the transfer of blended dry batches to the GTF. Blend samples will be tested for compliance to the ±5% (by weight) tolerance for each component set forth in OSD-T-151-00021.

The analysis of the blended material must be 100% complete before transferring the blend to the GTF. If a batch analysis is out of specification, all batches since the last inspection sample are considered out of specification, and an analysis of the magnitude of the error is conducted. This analysis includes an estimate of the amount of off-specification material produced, the impact on grout properties of the use of this material, and a determination of the cause of the error. No out-of-specification dry blend will be sent to the GTF while the evaluation is being made. More frequent sampling may be requested by Process Engineering as the facility is starting up or after a problem occurs.

#### 4.6.4 Analysis of Blended Material

The weight percent of each component will be determined by Fourier Transform Infrared Spectrometry.

### 4.7.0 SAMPLE POINT B-2 -- BLEND IN STORAGE BIN AT DRY MATERIALS FACILITY

After the blending operation, the material is dropped into the storage bin. A sample may be taken from this bin to verify that the formulation used for grout processing meets the processing and product specifications for a ±5 weight percent range for each component of the mixture.

#### 4.7.1 Sampled Materials

A sample of the blended dry materials is removed from the storage bin for analysis.

#### 4.7.2 Sampling Methods

The material is sampled using a scoop sampler per operating procedure TO-390-225. Scoop sampling is discussed in ASTM E 300-86.

#### 4.7.3 Sampling Requirements and Bases

There is no requirement to sample at this optional sampling point.

#### 4.7.4 Analysis of Blended Dry Material

The blended material will be analyzed for verification to processing and product specifications for a ±5 weight percent range of each component in the mixture. The weight percent of each component will be determined by Fourier Transform Infrared Spectrometry.

### 4.8.0 SAMPLE POINT B-3 -- BLEND AT LOAD TRUCK AT DRY MATERIALS FACILITY

The blended material is transferred from the blended material storage bin to the loading truck and sampled. These samples may be taken to verify blend mix specifications. This is an optional sampling point.

#### 4.8.1 Sampled Materials

Blended dry material is sampled at this point.

### 4.8.2 Sampling Methods
Materials are sampled with an automated sampler using operating procedure TO-390-030.

### 4.8.3 Sampling Requirements and Bases
There is no requirement to sample at this optional sampling point.

### 4.8.4 Analysis of Blended Dry Material
The blended material will be analyzed for verification to processing and product specifications for a ±5 weight percent range of each component in the mixture. The weight percent of each component will be determined by Fourier Transform Infrared Spectrometry.

## 4.9.0 SAMPLE POINT B-4 -- BLEND IN LOAD TRUCK AT DRY MATERIALS FACILITY

The blended material transferred from the storage bins to the loading truck is sampled in the truck before departure from the DMF. These samples may be taken to verify blend mix specifications. This is an optional sampling point.

### 4.9.1 Sampled Materials
The blended material from the storage bin is sampled in the transport truck at this point.

### 4.9.2 Sampling Methods
The materials sampled at this point are extracted using a thief grab sampler using procedure ESP-G-080-00107.

### 4.9.3 Sampling Requirements and Bases
There is no requirement to sample at this optional sampling point.

### 4.9.4 Analysis of Blended Dry Material
The blended material will be analyzed for verification to processing and product specifications for a ±5 weight percent range of each component in the mixture. The weight percent of each component will be determined by Fourier Transform Infrared Spectrometry.

## 4.10.0 SAMPLE POINT B-5 -- BLENDED MATERIAL IN TRUCK AT GPF

The blended material is sampled from the transport truck at the GPF. These samples may be taken to verify blend mix specifications. This is an optional sampling point.

### 4.10.1 Sampled Materials
The blended material in the transport truck can be sampled before being transferred into the day bin at the GTF.

### 4.10.2 Sampling Methods

The blended material is sampled at this point using a thief grab sampler per ESP-G-080-00107.

### 4.10.3 Sampling Requirements and Bases

There is no requirement to sample at this optional sampling point.

### 4.10.4 Analysis of Blended Dry Material

The blended material will be analyzed for verification to processing and product specifications for a ±5 weight percent range of each component in the mixture. The weight percent of each component will be determined by Fourier Transform Infrared Spectrometry.

## 4.11.0 SAMPLE POINT B-6 -- BLENDED MATERIALS FROM UNLOADING TRUCK

The blended material from the unloading truck may be sampled while offloading into the day bin at the GPF. This is an optional sampling point.

### 4.11.1 Sampled Materials

The blended material transferred from the loading truck is sampled at the GTF.

### 4.11.2 Sampling Methods

The blended dry material is sampled with automated sampler M20 per operating procedure TO-390-103.

### 4.11.3 Sampling Requirements and Bases

There is no requirement to sample at this optional sampling point.

### 4.11.4 Analysis of Blended Dry Material

The blended material will be analyzed for verification to processing and product specifications for a ±5 weight percent range of each component in the mixture. The weight percent of each component will be determined by Fourier Transform Infrared Spectrometry.

## 4.12.0 SAMPLE POINT B-7 -- BLENDED MATERIAL IN DAY STORAGE BIN AT GPF

This sampling point is located at the day storage bin. This bin holds the blended material received from the hopper trucks until needed for grout mixing and pumping operations. The blended material is sampled from the bin. This is an optional sampling point.

**4.12.1 Sampled Materials**
The blended material transferred from the trucks is sampled at this point.

**4.12.2 Sampling Methods**
The materials sampled at this point are extracted using a scoop sampler using procedure TO-390-103.

**4.12.3 Sampling Requirements and Bases**
There is no requirement to sample at this optional sampling point.

**4.12.4 Analysis of Blended Dry Material**
The blended material will be analyzed for verification to processing and product specifications for a ±5 weight percent range of each component in the mixture. The weight percent of each component will be determined by Fourier Transform Infrared Spectrometry.

**4.13.0 SAMPLING POINT B-8 -- BLENDED MATERIAL TO MIXER AT GPF**

The blended material from the day storage bin is transferred to the mixer before use in the grout and pumping operations. A sample is taken of the mixed material at the GTF between the weigh belt feeder and the tramp material screen. This sample is taken to verify the blend mix specifications.

**4.13.1 Sampled Materials**
A sample of the blended dry material is sampled from the grout mixer located in the liquid collection tank (LCT)/mixer module.

**4.13.2 Sampling Methods**
Materials are sampled with automated sampler M14 per procedure TO-390-103.

**4.13.3 Sampling Requirements and Bases**
There is no commitment to sample at this optional sampling point. A sample may be taken to verify that the dry blend is within the specification.

**4.13.4 Analysis of Blended Dry Material**
The blended material will be analyzed for verification to processing and product specifications for a ±5 weight percent range of each component in the mixture. The weight percent of each component will be determined by Fourier Transform Infrared Spectrometry.

## 4.14.0 SAMPLE POINT A-1 -- FLUIDIZER TANK AT GPF

This sample point is located at the fluidizer tank (R01) which is part of the set of tanks holding grout liquid additives. Fluidizer additive may be sampled at this point. No additive is currently planned.

## 4.15.0 SAMPLE POINT A-2 -- AIR DEENTRAINER TANK AT GPF

This sample point is located at the air deentrainer additive tank (R02) which is part of the set of tanks holding grout liquid additives. The additive may be sampled from its holding tank. No additive has been specified for use at this time.

## 4.16.0 SAMPLE POINT A-3 -- SET REGULATOR TANK AT GPF

This sample point is located at the set regulator additive tank which is part of the set of tanks holding grout liquid additives. The additive may be sampled from its holding tank. No additive has been specified at this time.

## 4.17.0 SAMPLE POINT D-1 -- DECONTAMINATION TANK AT GPF

This sample point is located at the decontamination solution storage tank. The decontamination solution will be sampled from this holding tank. Water was previously used as the decontamination solution. A citric acid decontamination solution is proposed for future applications. Other choices may be necessary, based on the choice of dry blend formulation. This is an optional sampling point.

### 4.17.1 Sampled Materials
The decontamination solution in the decontamination tank may be sampled.

### 4.17.2 Sampling Methods
Sampling methods will be specified when a decontamination solution is chosen.

### 4.17.3 Sampling Requirements and Bases
Process Engineering may require sampling of the decontamination tank upon addition to or dilution of the tank contents.

### 4.17.4 Analysis of Decontamination Solution
No decontamination solution has been specified at this time. The analyses to be conducted on the decontamination solution will be specified by Process Engineering once a solution is chosen.

## 4.18.0 SAMPLE POINT D-2 -- CAUSTIC/NITRITE TANK AT GPF

This sample point is at the caustic/nitrite tank (R04), also as known as the pH adjustment tank. This tank is located with the decontamination solution storage tanks and used for neutralization of decontamination solutions and flush water for DST storage. The sample is taken from this tank to verify solution specifications. The solution will most likely be mixed and sampled at another onsite facility or purchased from offsite. Therefore, this is an optional sampling point.

### 4.18.1 Sampled Materials

The solution from the caustic/nitrite tank will sampled.

### 4.18.2 Sampling Methods

A dip sample may be taken from the tank.

### 4.18.3 Sampling Requirements and Bases

Process Engineering may require sampling of the caustic/nitrite tank upon addition to or dilution of the tank contents.

### 4.18.4 Analysis of Caustic/Nitrite Solution

The caustic/nitrite solution may be analyzed for $OH^-$ and $NO_2^-$. The analytical methods used are listed in Appendix 2.

## 4.19.0 SAMPLE POINTS F-1 AND F-2 -- GROUT WASTE FEED TANKS 241-AP-102 AND 241-AP-104

The material in the feed tanks will be sampled before the commencement of grouting operations. Feed tank sampling will provide samples for characterization and grouting in the laboratory to verify that the waste batch can be processed safely into a form suitable for long term grout disposal.

### 4.19.1 Sampled Materials

Grout waste feed is sampled for characterization after the waste is received in grout feed tanks 241-AP-102 or 241-AP-104. After the transfer of the material into the waste feed tank, the tank is administratively isolated to prevent inadvertent transfer of material into the tank.

### 4.19.2 Sampling Methods

The method used to sample the tanks is described in the Section 6.1 of the Double-Shell Tank Waste Analysis Plan (Halgren 1991):

"Waste stored in the tank farms in the 200 Areas is sampled using the 'bottle-on-string' method. This method was developed to meet ASTM procedure E300-73, Weighted Bottle Method (ASTM 1973). Samples are obtained by opening a riser and lowering a weighted bottle to the desired depth below the surface of the liquid."

The Tank Farms procedure for sampling non-aging waste tanks is TO-080-030. A 100 mL bottle is used.

### 4.19.3 Sampling Requirements and Bases

Sampling is done at least 4 to 5 months before processing the waste to allow for sufficient analytical time. Feed tanks will be mixed during blending and/or prior to sampling. Three risers are randomly selected for sampling. At least three samples are taken from each riser, at random depths. A duplicate sample is taken from each third of the tank (top, middle, and bottom). Additional duplicates are taken from sample locations determined from a random number generator..

Sludge is not expected due to blending practices (i.e., adding dilute waste to the tank before blending with concentrated waste) and recirculation to keep the temperature elevated (solids will dissolve or be in suspension). Sludge measurements are taken before sampling. If sludge is present in the feed tank, the tank is mixed using the in-tank mixer prior to sampling. At least one sample is taken from below the detected sludge level.

Each batch of material received into the feed tanks requires a tank sampling plan with a set of randomly generated risers and sampling depths. Each new batch of material received into the feed tanks must be characterized before it is grouted. The Grout Treatment Facility Waste Feed Acceptance Criteria (WHC-SD-WM-RD-019, Hendrickson 1991a) establishes the criteria for the acceptance of grout waste feed.

In addition, sampling is required in the feed tanks to determine compliance with the Land Disposal Restrictions (LDR). Since the grout feed will carry waste codes F003 and F005, compliance with the non-waste water standards for constituents of these codes must be attained prior to final grouting. The LDR Management Plan (Hendrickson, 1991b) details these requirements.

### 4.19.4 Analysis of Grout Waste Feed

The grout waste feed will be analyzed to verify that it meets waste feed specifications. The required analyses and methods are listed in Appendix 2.

If the concentration of a waste constituent is found to be outside of the ranges established for grout feed material, an analysis will be conducted by the operating contractor to determine the impact of this deviation. If the analysis shows that there will be no significant effect caused by this deviation, The Washington Department of Ecology (Ecology) will be provided the impact analysis and required to provide written approval for processing of this grout campaign. Such a deviation would require a change to the GTF Safety Analysis Report (unreleased) and other lower tier documents. If the impact analysis indicates that the grout feed waste is not suitable for grout processing, the waste is transferred from the tank into the DST system for continued storage until the waste can be reprocessed to be acceptable for grout processing.

## 4.20.0 SAMPLING POINT C-1 -- LIQUID COLLECTION TANK

This sampling point is located at the LCT. This tank serves as the collection point for all contaminated liquids that are not incorporated in the grout. This tank collects any spill or leakage collected in the sump and spent flush and decontamination solutions from internal or external system cleanup. Vault excess liquid and leachate could be sampled here but will likely be sampled at sample points BW-1 and L-1 as bottle-on-string sampling results in lower doses to sampling personnel than glovebox sampling.

This tank serves as an accumulation tank for wastes and may come in direct contact with mixed wastes. The liquid from this tank is sampled and characterized to evaluate the necessary caustic and/or nitrite additions for proper adjustment of the liquid prior to transfer to the Tank Farms.

### 4.20.1 Sampled Materials

Liquid waste contained in the LCT is sampled.

Samples of excess liquid and vault leachate may be taken at sample points BW-1 and L-1, thus eliminating the need to sample these wastes at the LCT.

### 4.20.2 Sampling Methods

The LCT is sampled per procedure TO-390-157. The liquid waste samples are obtained in sample bottles which are filled in a glove box sampler. Tank liquids are circulated through the sampler box piping and a fraction of the liquid is extracted into a sample bottle. Sample bottles fit into the 2-in diameter cavity in a lead-lined 6-in diameter "sample pig" for transporting to the analytical laboratory.

*There are outstanding safety concerns regarding use of glovebox sampling for high activity samples. This document will be changed to conform to the approved sampling technique.*

### 4.20.3 Sampling Requirements and Bases

The requirements of the *Double-Shell Tank Waste Analysis Plan* (Halgren, 1991) must be met for all transfers. The waste may be accepted by Tank Farms Process Engineering without sampling each transfer if sufficient previous analyses and documented process knowledge exist.

### 4.20.4 Analysis of Liquid from LCT

The required components and characteristics to be analyzed and the analytical methods are listed in Appendix 2.

## 4.21.0 SAMPLE POINT G-X -- NON-ROUTINE SAMPLE

Any sampling which is not covered under the other sampling points of this plan falls under sample point G-X. Sampling is directed by Process Engineering.

### 4.21.1 Sampled Materials

A sample of a material used or produced in the grout process is sampled.

### 4.21.2 Sampling Methods

The sampling method will be determined by Process Engineering at the time of sampling.

### 4.21.3 Sampling Requirements and Bases

G-X samples are taken as desired to obtain information.

### 4.21.4 Analysis of Non-Routine Sample

The analyses for this sample will be determined by Process Engineering at the time of sampling.

## 4.22.0 SAMPLING POINT L-1 -- LEACHATE

This sample point is located at the leachate detection/collection and removal system (LDCRS) at the disposal vault. The LDCRS is located between the upper and lower liner systems and removes leachate from each vault. Leachate from the vault is sampled to verify DST Waste Analysis Plan requirements (Halgren, 1991).

### 4.22.1 Sampled Materials

Leachate collected in the drain of the LDCRS is sampled.

### 4.22.2 Sampling Methods

The leachate is sampled using the 'bottle-on-string' method described in Section 4.19.2.

### 4.22.3 Sampling Requirements and Bases

The leachate is sampled and analyzed to confirm acceptance for storage in the DSTs and to meet the acceptance criteria and documentation requirements.

Halgren (1991) states that the waste streams entering the DSTs are characterized in order to meet WAC 173-303 requirements (Ecology, 1991). The WAC 173-303-300(2) states:

"The owner or operator shall obtain a detailed chemical, physical and/or biological analysis of a dangerous waste before he stores, treats, or disposes of it. This analysis must contain the information necessary to manage the waste in accordance with the requirements of this chapter 173-303 WAC."

The sampling requirements for LDCRS monitoring and sampling are specified in the Response Action Plan, Appendix 7A of the GTF Dangerous Waste Permit Application (DOE/RL 1991a). These requirements are defined as follows:

> Pumpable quantities of leachate contained in the sump will be sampled, removed, and disposed of in accordance with site procedures.......Samples will be taken quarterly or before the liquid is removed from the sump, as long as the leak rate does not exceed the action leak rate (ALR). Samples will be taken within 24 hours of the leak rate exceeding the ALR and will continue to be taken on a weekly frequency until no significant change in radionuclide composition is detected for three consecutive sampling periods. At that time, the sampling frequency will be reduced to monthly as long as the leak rate remains above the ALR and analysis indicates that the sump liquid composition has not changed. Significant increases in the leak rates or changes in the sump liquid composition will increase the sampling frequency to weekly. Additional samples will be taken as needed to help define response actions and mitigation measures.

Leak rates in excess of the ALR (8 gal/day for a 30 day average or 20 gal on any 1 day) are defined below:

- Flow rates between 8 gal/day and 800 gal/day would indicate that an excess amount of liquid is entering the leachate sump.

- Flow rates greater than 800 gal/day would indicate that a major source of liquid is finding a path to the leachate sump.

The required activities for the leakage rates are listed in Sections 6.2 and 6.3, respectively, of the Response Action Plan (Appendix 7A of DOE/RL 1991a). Sampling requirements for leak rates in excess of the ALR will be determined when the flows are detected.

### 4.22.4 Analysis of Leachate

The analysis requirements for the leachate are specified in the Response Action Plan, Appendix 7A of the Grout Part B Permit Application (DOE/RL, 1991a). These requirements are defined as follows:

"Samples taken from the sump will be analyzed for gamma emitters to determine if the liquid leaked from inside the vault. In addition, sufficient analyses will be conducted to designate the sump liquid in accordance with WAC 173-303."

The analyses and methods for the leachate are tabulated in Appendix 2.

## 4.23.0 SAMPLE POINT P-1 – GROUT IN VAULT

This sample point is located at the grout vault. The grout product mixture is sampled to verify that the final product meets wasteform performance requirements.

### 4.23.1 Sampled Materials
The grout product in the vault is sampled.

### 4.23.2 Sampling Methods
The grout may be sampled by core drilling specimens of the solidified product with a dedicated, truck mounted drilling rig.

### 4.23.3 Sampling Requirements and Bases
Grout sampling requirements have been negotiated with the Washington Department of Ecology (Ecology). Section 3.3.4 of DOE/RL 1991a states "At a minimum, the first mixed waste vault (Vault 102) will be core drilled to ensure that the grout has solidified. The amount of physical sampling will be reduced, or eliminated entirely, once nondestructive testing techniques have been demonstrated to indicate grout quality."

### 4.23.4 Analysis of Grout in Vault
Grout samples removed from the vault will be tested to determine if they meet the regulatory requirement of 200 $lb_f/in^2$ unconfined compressive strength (DOE/RL 1991a). The program target is 500 $lb_f/in^2$ (Fadeff & Riebling 1991).

In addition, the Toxicity Characteristic Leaching Procedure (TCLP) will be followed to determine compliance with the Land Disposal Restrictions of RCRA for leachable metals.

## 4.24.0 SAMPLE POINT BW-1 -- EXCESS LIQUID AT THE GROUT DISPOSAL FACILITY

The vault design provides access for sampling excess liquid at the Grout Disposal Facility.

### 4.24.0 Sampled Materials
The excess liquid from the grout is sampled from the vault. Excess liquid includes liquid that has separated from the grout due to settling of solids before solidification and unabsorbed liquid from line flushes or decontamination activities.

### 4.24.2 Sampling Methods
The excess liquid is collected by bottle-on-string sampling in accordance with operating procedure TO-390-208. This procedure is described in Section 4.19.2.

### 4.24.3 Sampling Requirements and Bases
The excess liquid is sampled and analyzed to confirm acceptance for return storage in the DSTs. The requirements of the DST Waste Analysis Plan (Halgren, 1991) must be met for all transfers. The waste may be accepted by Tank Farms without sampling each transfer if sufficient previous analyses and documented process knowledge exist.

#### 4.24.4 Analysis of Excess Liquid

The excess liquid is characterized before being sent to the DSTs. The list of analyses is tabulated in Appendix 2.

### 4.25.0 SAMPLE POINT V-1 – LCT/MIXER MODULE STACK

This sampling point is located at the vent of the LCT/Mixer Module. This vent is defined as a stack as it removes air or gas from a contaminated area by a mechanical exhauster.

Health physics personnel conduct sampling per procedures in WHC-IP-0692, *Health Physics Procedures Manual.* This section is for information only.

#### 4.25.1 Sampled Materials

Minor quantities of radioactive contaminated particulates and semi-volatile radionuclides will be discharged from the stack. The airborne emissions from the stack are sampled for characterization. Radionuclides are sampled through a paper filter record sampler. A beta/gamma continuous air monitor (CAM) is provided to monitor and alarm if abnormal conditions occur.

Tritium ($^{3}H$) will be also be sampled.

#### 4.25.2 Sampling Methods

The record sampler allows analytical measurements of the radionuclides collected in particulate form. Particulates are collected on 47 mm circular filters. These filters are collected by Operational Health Physics (OHP) personnel quarterly and delivered to the 222-S Laboratory. These samples are decayed for one week, and then analyzed. Analysis of samples are reported to the Environmental Protection Group and the OHP group.

The gross beta and gamma constituents are sampled through a Eberline CAM Model AMS-3 sampler. A beta/gamma continuous air monitor and record sampler are used to continuously monitor and sample effluents from the stack. The sampling mechanism operates by first using a vacuum pump to draw a representative sample through the monitor at a rate of approximately 2 cfm. A second vacuum pump withdraws another representative sample through a gas flowmeter and a filter paper assembly. The CAM alarms will be annunciated locally and in the GPF control room.

Tritium will be captured by a contact condenser (bubbler).

#### 4.25.3 Sampling Requirements and Bases

Radioactive airborne sampling, monitoring, and alarm requirements are listed in *Environmental Compliance* (WHC-CM-7-5, WHC 1991d). Per Part D, Section 7.0.8 of WHC-CM-7-5, any potential radioactive gas stream discharged to the environment must be measured with a minimum detection level of 10% of the Derived Concentration Guides (DCGs) listed in Appendix A of WHC-CM-7-5.

Per WHC-CM-7-5, Part D, Section 7.0.2, sampling systems shall be provided for all airborne effluents that have the potential to exceed 10% of any DCG-Public value on an annual average.

Specific isotopic radionuclide analysis shall be performed on quarterly composites of record sampled in accordance with the criteria in Part D, Section 7.0.7 of WHC-CM-7-5.

Airborne radionuclide emissions from the GTF are subject to the National Emission Standards for Hazardous Air Pollutants (NESHAP) (EPA, 1989). Continuous radionuclide monitoring requirements under NESHAP are based upon the potential of a facility stack to release radionuclides and cause an offsite dose consequence of 0.10 mrem/yr effective dose equivalent to the maximally impacted individual. Such potential release is based upon an assumption of direct release, without emission control, while otherwise operating at capacity. Per data in Hendrickson 1991c, continuous monitoring is not required.

Tritium will be sampled and analyzed weekly while the exhauster is operating.

Sampling systems shall provide representative sampling. Standard error in proportional sampling shall not exceed 20% on a continuous basis (i.e., near isokinetic) per WHC-CM-7-5 Part D, Section 7.0.3. Other data requirements will be determined at the time of sampling.

### 4.25.4 Analysis of GPF Emissions

The gross beta constituent is routinely analyzed following method LA-508-105. The analysis program will follow a program equivalent to the EPA Environmental Monitoring Lab.

## 4.26.0 SAMPLING POINT V-2 -- VAULT EXHAUSTER

This sampling point is located at the vault ventilation system. The function of the system is to limit airborne emissions from the vault during the operation and solidification phase. The vent filters exhaust air through HEPA filters to ensure that emissions of particulate materials are within applicable standards for radiological constituents. The emissions is sampled for characterization in comparison to the modelled effective dose equivalent (EDE).

The vault exhauster consists of a flexible connector that attaches to a vault riser, an isolation valve, an air heater to reduce the exhaust air relative humidity to less than 70%, two HEPA filters in series, an exhaust fan with automatic speed control, exhaust monitoring and sampling equipment, and an exhaust stack.

Radionuclide airborne emissions from the GTF are subject to NESHAP regulations (EPA, 1989). Continuous radionuclide monitoring requirements under NESHAP are based upon the potential of a facility stack to release radionuclides and cause an offsite dose consequence of 0.10 mrem/yr effective dose equivalent to the maximally impacted individual. Such potential release is based upon an assumption of direct release, without emission control, while otherwise operating at capacity.

Health physics personnel conduct sampling per procedures in WHC-IP-0692, *Health Physics Procedures Manual* (WHC 1991b). This section is for information only.

**4.26.1 Sampled Materials**

Radionuclides are sampled through a paper filter record sampler. A beta/gamma continuous air monitor (CAM) is provided to monitor and alarm if abnormal conditions occur.

Tritium ($^3H$) and Iodine-129 will be also be sampled.

**4.26.2 Sampling Methods**

The vault exhaust air monitoring system measures stack flow and temperature, provides isokinetic sample flows for a particulate sampler and for a beta/gamma monitor, provides sample flow for an iodine sampler and tritium sampler, and has provisions to take draegger tube grab samples. This system meets the requirements of ANSI 13.1 (ANSI, 1969).

Samples are removed from the vault vent following 40 CFR 60 "EPA Regulations on Standards of Performance for New Stationary Sources", Method 5 "Determination of Particulate Emissions from Stationary Sources." Particulate matter is withdrawn isokinetically from the source and collected on a fiber filter maintained at a temperature at or above the exhaust gas temperature according to Method 5D, "Determination of Particulate Matter Emissions from Positive Pressure Fabric Filters." In addition, Method 5F, "Determination of Nonsulfate Particulate Matter from Stationary Sources," is followed for extracting a portion of the sampled emissions for sulfate content. Emissions are removed ensuring integrated and representative samples from the vent.

Tritium will be sampled by means of a contact condenser (bubbler).

**4.26.3 Sampling Requirements and Bases**

Any potential radioactive gas stream discharged to the environment must be measured with a minimum detection level of 10% of the Derived Concentration Guides (DCG) listed in WHC-CM-7-5 (WHC, 1991d).

Stack record air samples shall be collected at a sample flow rate and over a sufficient time to achieve analytical requirements. Unless otherwise informed, to achieve the analytical requirements the samples should be collected at a flow rate of 0.06 cu.

meters/minute (2 cfm) for a minimum of 1 week. Any reduction in flow rate or sample collection period will cause a proportional increase in the analytical detection level.

HEPA filter conditions will be monitored during operation, and the filters will be replaced when the differential pressure indicates that the filter is loaded or when filter efficiency decreases below 95.5%.

Iodine-129 and tritium will be sampled and analyzed weekly during operation of the exhauster.

### 4.26.4 Analysis of Vault Exhauster Emissions

Specific radionuclide analysis shall be performed on quarterly composites of record samples. Analysis will include beta/gamma, I-129, and tritium.

Since the stacks will have average flow rates less than 280 cubic meters/minute (10,000 cfm), specific radionuclide analysis will be required when the total alpha or total beta concentration exceeds 50% of the DCG-Public value for the most restrictive radionuclide not known to be absent from the stream (based upon process knowledge and/or source term characterization).

When the ratio of isotopes present in the discharge is unknown or changing, the isotope present with the most restrictive DCG-Public value shall be assumed for the gross beta/gamma and gross alpha activity.

## 4.27.0 SAMPLING POINT V-3 -- DAY BIN DUST COLLECTOR VENT

A dust collector is mounted on top of the day bin at the GTF to vent conveying air during bin filling operations. Source tests were performed during acceptance testing; the results show that emissions from the dust collector vent are within regulatory limits (APCA, 1980). There are no regulations that require this dust collector vent be tested periodically. Therefore, routine monitoring will not be performed.

## 4.28.0 SAMPLING POINT V-4 A-E -- ADDITIVE AND DECONTAMINATION VENTS

The contents of the additives and decontamination tanks are vented to prevent overpressurization or overfilling. Since the additives and pH adjustment solutions are stored at ambient temperature, vapors generated within the tanks are assumed to be negligible. The contents of the decontamination tank, however, are stored at an elevated temperature and the vapors generated from this tank are vented directly to the atmosphere. Since this tank will not hold dangerous or carcinogenic material, there is no need for monitoring or sampling of this airborne discharge.

## 4.29.0 SAMPLING POINT V-5 A-E -- DRY MATERIALS AND BLENDED MATERIAL STORAGE BIN VENTS

Each of the five storage bins is equipped with a vent fan and bag filter. A dust collector is mounted on top of each of the bins to vent conveying air during filling operations and to maintain a slight negative pressure within each of the bins. Acceptance source test and opacity measurements of the filters were performed as the materials in the bins were being aerated. The results show that the emissions from each dust collector are within regulatory limits (APCA 1980). There are no regulations that require these sources to be tested periodically. Continuous monitoring, and therefore sampling, are not necessary or required.

## 4.30.0 SAMPLING POINT W-2 -- FAILED EQUIPMENT

Failed GTF equipment may require sampling prior to transport to a disposal or decontamination/maintenance unit. If the repair is not feasible or cost effective, the failed equipment is analyzed to determine the disposal requirements and packaged for onsite disposal in accordance with established procedures and applicable regulations WHC 1988). Process knowledge (of waste feed, dry blend, decontamination solution, etc.) will be used to limit the amount of sampling necessary for characterization.

## 4.31.0 SAMPLING POINT W-3 -- ABSORBED DECONTAMINATION MATERIALS

Solid absorbent material is generated from the cleanup of small spills of decontamination solutions, the drying of decontaminated equipment, or the direct application of decontamination solutions to equipment or structures. The material is collected into containers and consolidated for disposal. Before disposal, the contents of the container are analyzed (if required for classifications) and classified to determine the correct disposal site for the waste. The waste is repackaged, if required, and disposed of at an onsite unit in accordance with established procedures and applicable regulations. Process knowledge (of waste feed, dry blend, decontamination solution, etc.) will be used to limit the amount of sampling necessary for characterization.

## 4.32.0 SAMPLING POINT W-4 -- FACILITY MAINTENANCE WASTES

Maintenance wastes such as radioactively contaminated rags or nonradioactive greases and oils may be generated at the Grout Facilities. These solid wastes will be packaged and dispositioned according to approved procedures (WHC-EP-0063, WHC 1988). Since these wastes will not be stored at the facility for any significant period of time, there is little potential for airborne or liquid discharge. Monitoring or sampling, therefore, is not predicted to be required. However, future sampling requirements may impose sampling of French drains and drywells.

## 4.33.0 SAMPLING POINT G-1-8 -- GROUNDWATER WELLS

There are currently three upgradient wells and five downgradient wells near the GTF.

As discussed in Section 2.0, this section is for information only; groundwater sampling is monitored by WHC Environmental Division. The *Interim-Status Groundwater Monitoring Plan for the Grout Treatment Facility*, (WHC-SD-EN-AP-006, Weekes 1989) and Chapter 5 of the GTF Dangerous Waste Permit Application (DOE/RL 1991a) are the controlling documents.

### 4.33.1 Sampled Materials

Groundwater samples will be removed from upgradient and downgradient wells.

### 4.33.2 Sampling Methods

All sampling activities are performed under contract by Pacific Northwest Laboratory (PNL). Groundwater sample collection, including well evacuation and sample withdrawal methods, are performed following *Procedures for Groundwater Investigations* (PNL, 1989).

### 4.33.3 Sampling Requirements and Bases

All monitoring wells are required to have baseline values established with samples obtained quarterly over a period of one year per 40 CFR 265.92(c)(1) (EPA 1989). Thereafter, samples are taken semiannually from each well for the life of the GTF.

### 4.33.4 Analysis of Groundwater Samples

Sample analysis will be carried out by a contract laboratory. . An abbreviated list of constituents to be analyzed for is included in Appendix 2 (adapted from DOE/RL, 1991b). The full list, and analytical methods to be used, are given in App. C of Weekes, 1989.

## 4.34.0 VAULT HYDROGEN/OXYGEN SAMPLING

Sampling and/or monitoring of vault hydrogen/oxygen concentrations may be required. This issue is in the process of being resolved. Vault hydrogen/oxygen sampling is TBD (TBD-WM-020) at this point.

## 5.0 REFERENCES


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>
> *Standard Specification for Portland Cement*, ASTM C 150-89;
>
> *Standard Test Methods for Sampling and Testing Flyash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete*, ASTM C311-90;
>
> *Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete*, ASTM C 618-89;
>
> *Standard Practice for Sampling Industrial Chemicals*, ASTM E 300-86.

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**Figure 1.**
***MINIMUM REQUIRED SAMPLING POINTS***

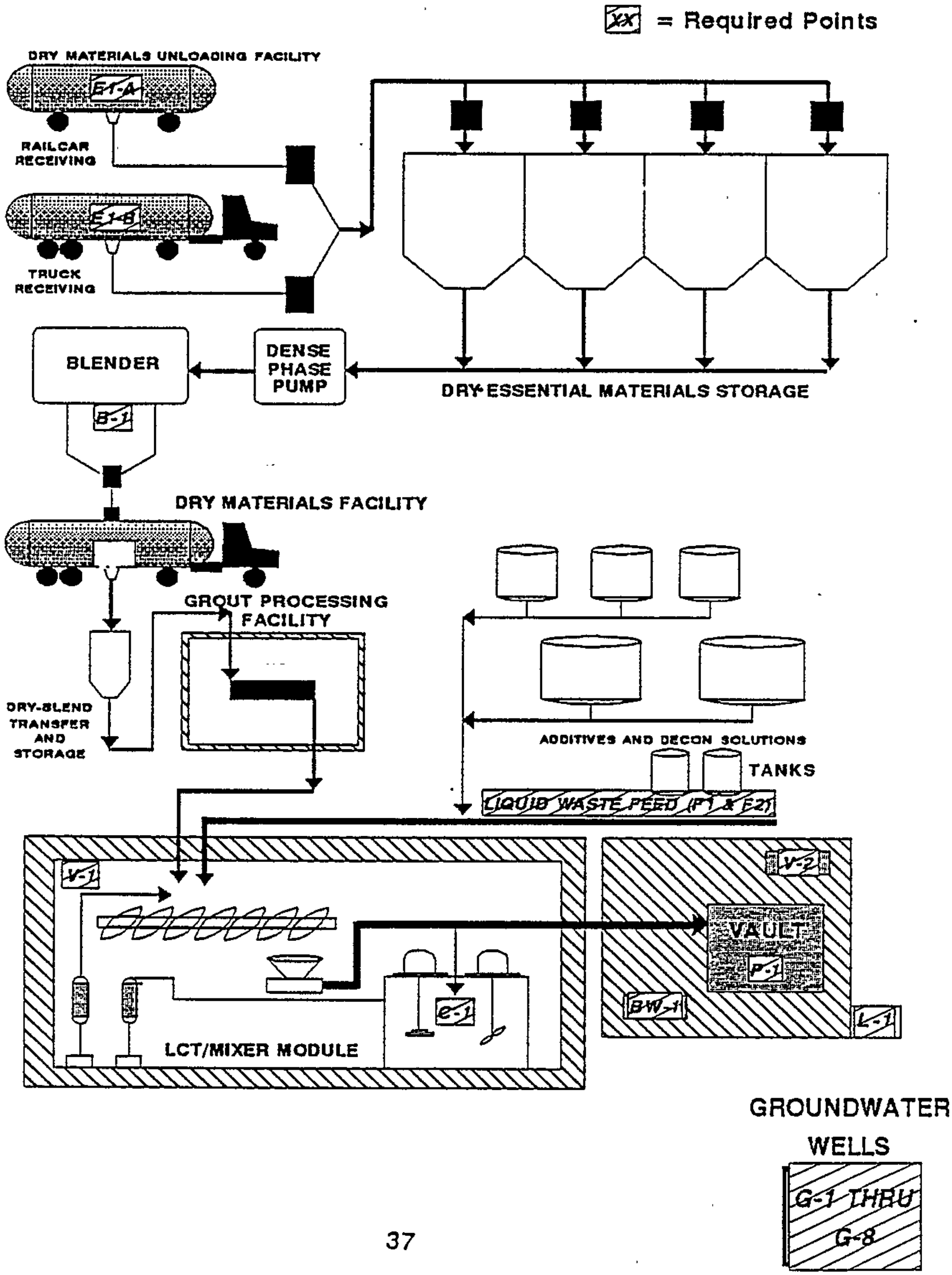
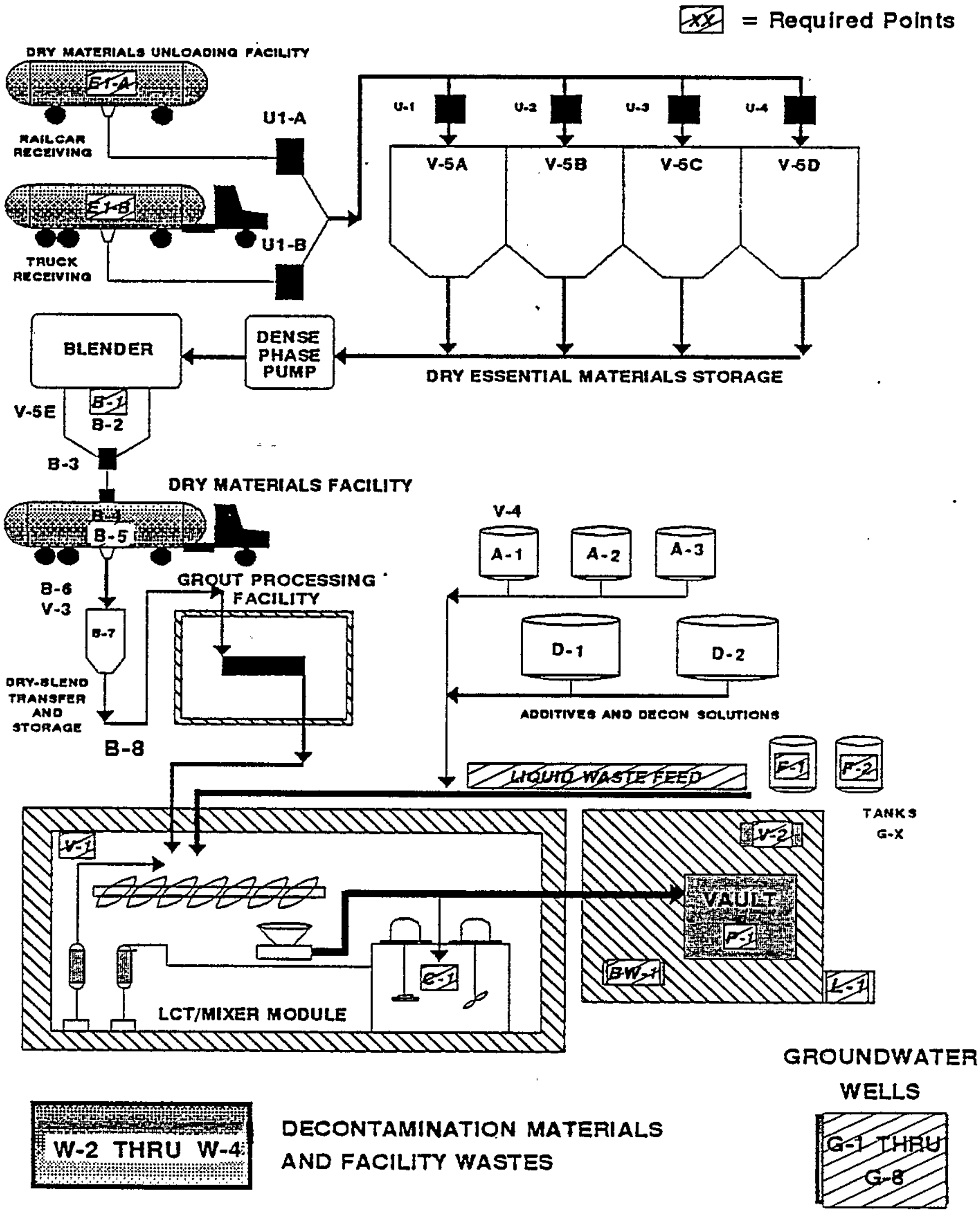


Figure 2.
ALL SAMPLING POINTS FOR GROUT PROCESSING
(REQUIRED & OPTIONAL POINTS)






9 2 1 2 6 4 1 1 8 0 1

## Appendix 1. Sample Collection Information

Appendix 2 lists the analytical requirements for GTF samples.

| Sample Point | Sample Location | Material(s) | Sampling Method(s) | Utility | Sample Size | Sample Frequency | Turnaround Time |
|---|---|---|---|---|---|---|---|
| E1-A | Rail Car Delivery | Essential Dry Material | Sampling Thief ESP-G-080-00107 | Verify Compliance With Purchase Specifications | 1/2 Lb. | Each Shipment | 1 hr |
| U1-A | Rail Car Unloading | Essential Dry Material | Automated Composite Sampler TO-390-055 | Verify Compliance With Purchase Specifications | 1 Lb. | N/A (Optional) | 1 hr |
| E1-B | Truck Delivery | Essential Dry Material | Sampling Thief ESP-G-080-00107 | Verify Compliance With Purchase Specifications | 1/2 Lb. | Each Shipment | 1 hr |
| U1-B | Truck Unloading | Essential Dry Material | Automated Composite Sampler TO-390-055 | Verify Compliance With Purchase Specifications | 1 Lb. | N/A (Optional) | 1 hr |
| U-1 | Bin 2402 EB | Essential Dry Material | Scoop Sample TO-390-025 | Verify Compliance With Purchase Specifications | 4 oz. | N/A (Optional) | 1 hr |
| U-2 | Bin 2402 EC | Essential Dry Material | Scoop Sample TO-390-025 | Verify Compliance With Purchase Specifications | 4 oz. | N/A (Optional) | 1 hr |
| U-3 | Bin 2402 ED | Essential Dry Material | Scoop Sample TO-390-025 | Verify Compliance With Purchase Specifications | 4 oz. | N/A (Optional) | 1 hr |
| U-4 | Bin 2402 EF | Essential Dry Material | Scoop Sample TO-390-025 | Verify Compliance With Purchase Specifications | 4 oz. | N/A (Optional) | 1 hr |
| B-1 | Dry Material Blender (DMF) | Dry Blend | Automated Composite Sampler TO-390-035 | Verify Blend Mix Specifications | 1 Lb. | 1 per 20 Batches | 1 hr |
| B-2 | Blended Storage Bin (DMF) | Dry Blend | Scoop Sample , TO-390-225 | Verify Blend Mix Specifications | 1 Lb. | N/A (Optional) | 1 hr |
| B-3 | Trailer Loading at DMF | Dry Blend | Automated Composite Sampler TO-390-030 | Verify Blend Mix Specifications | 1 Lb. | N/A (Optional) | 1 hr |
| B-4 | Trailer at DMF | Dry Blend | Sampling Thief ESP-G-080-00107 | Verify Blend Mix Specifications | 1 Lb. | N/A (Optional) | 1 hr |
| B-5 | Trailer at GPF | Dry Blend | Sampling Thief ESP-G-080-00107 | Verify Blend Mix Specifications | 1 Lb. | N/A (Optional) | 1 hr |
| B-6 | Trailer Unloading at GPF | Dry Blend | Automated Composite Sampler TO-390-103 | Verify Blend Mix Specifications | 1 Lb. | N/A (Optional) | 1 hr |
| B-7 | Day Bin | Dry Blend | Scoop Sample TO-390-103 | Verify Blend Mix Specifications | 1 Lb. | N/A (Optional) | 1 hr |
| B-8 | Blend at Mixer | Dry Blend | M14 Automated Composite Sampler TO-390-103 | Verify Blend Mix Specifications | 1 Lb. | N/A (Optional) | 1 hr |

## Appendix 1. Sample Collection Information

(continued)

| Sample Point | Sample Location | Material(s) | Sampling Method(s) | Utility | Sample Size | Sample Frequency | Turnaround Time |
|---|---|---|---|---|---|---|---|
| A-1 | Fluidizer Tank | Not Required | N/A | N/A | N/A | N/A | N/A |
| A-2 | Air Deentrainer Tank | Not Required | N/A | N/A | N/A | N/A | N/A |
| A-3 | Set Regulator Tank | Not Required | N/A | N/A | N/A | N/A | N/A |
| D-1 | Decontam-ination Tank | TBD (TBD-WM-021) | Grab | Verify Compliance With Purchase Specifications | TBD (TBD-WM-022) | TBD (TBD-WM-023) | TBD (TBD-WM-024) |
| D-2 | Caustic/ Nitrite Tank | Caustic/ Nitrite Solution | Grab | Verify Solution Specifications | TBD (TBD-WM-025) | TBD (TBD-WM-026) | TBD (TBD-WM-027) |
| F-1 | Feed Tank (AP-102) | Waste Feed Liquid | Weighted Bottle-On-String | Verify Waste Feed Specifications | As Required | 1 Sampling event/campaign | N/A |
| F-2 | Feed Tank (AP-104) | Waste Feed Liquid | Weighted Bottle-On-String | Verify Waste Feed Specifications | As Required | 1 Sampling event/campaign | N/A |
| C-1 | Liquid Collection Tank (GDF) | Liquid Process Waste | Glovebox Sampler TO-390-157 | Verify DST WAP Requirement | As Required | As Negotiated With Tank Farms | TBD (TBD-WM-028) |
| G-X | Non-Routine Sample (GPF) | Non-Routine Sample | As Required | N/A | As Required | As Required | N/A |
| L-1 | Leachate Sump (GDF) | Leachate in Sump | Weighted Bottle-On-String | Verify DST WAP Requirement | 100 mL | As Negotiated With Tank Farms | TBD (TBD-WM-028) |
| P-1 | Grout In Vault (GDF) | Grout Product | Core Drilling or Weighted Bottle-On-String | Verify Product Specifications | 100 mL | After filling of each vault | N/A |
| BW-1 | Vault Surface | Excess Liquid | 100 mL | Verify DST WAP Requirement | 100 mL | As Negotiated With Tank Farms | TBD (TBD-WM-028) |
| V-1 | LCT Mixer Module Vent Stack | Radioactive Vapors | Record Sampler | Airborne Quarterly Requirements | N/A | Continuous Monitoring Quarterly Sampling | N/A |
| V-2 | Vault Vent | Radioactive Vapors | Record Sampler | Airborne Quarterly Requirements | N/A | Continuous Monitoring Quarterly Sampling | N/A |
| V-3 | Day Bin Dust Collector Vent | Dust Emissions | Vent Filter (M-11) Pulse Jet Baghouse | Airborne (and Recycle) Requirements | N/A | N/A (Optional) | N/A |
| V-4 | Additive and Decontamination Vents | Hazardous Materials | Vent Filter and Vapor Traps | Airborne Requirements | N/A | N/A (Optional) | N/A |

**Appendix 1. Sample Collection Information**
(continued)

| Sample Point | Sample Location | Material(s) | Sampling Method(s) | Utility | Sample Size | Sample Frequency | Turnaround Time |
|---|---|---|---|---|---|---|---|
| V-5 | Dry Bin Storage Vents | Dust Emissions | Vent Fan, Filter Bag and Pulse Jet Filters | Airborne Requirements | N/A | N/A (Optional) | N/A |
| W-2 | Decontaminated Equipment | Radioactive Equipment | As Required | Characterization for Disposal | As Required | As Required | N/A |
| W-3 | Absorbed Decontamination Materials | Radioactive Wastes | As Required | Characterization for Disposal | As Required | As Required | N/A |
| W-4 | Facility Maintenance Wastes | Radioactive Wastes | As Required | Characterization for Disposal | As Required | As Required | N/A |
| G-1 Thru G-8 | Groundwater Wells | Well Water | Sampler Pump at 100 ml/ minute | Monitoring and Tracking of Release to Groundwater | As Required | 1 per 6 Months | N/A |

## Appendix 2. Analytical Requirements for GTF Samples

Apppendix 1 identifies the sample collection information.

| Material | Analysis | Min. | Max. | Unit | Analytical Method | Preferred Laboratory |
|---|---|---|---|---|---|---|
| Cement | Meet or Exceed ASTM C 150 | | | | ASTM C 150, ASTM C 114 | Vendor & 222-S |
| | and | | | | | |
| | Blaine Fineness | | 400.0 | $m^2/kg$ | ASTM C-204, LE 519-107 | Vendor & 222-S |
| | False Set/Final Penetration | 50% | | | ASTM C-451 | Vendor & 222-S |
| | $C_3A$ | | 8.0 | wt% | ASTM C-114 | Vendor & 222-S |
| | $C_3A+C_3S$ | | 58.0 | wt% | ASTM C-114 | Vendor & 222-S |
| | or | | | | | |
| | Equivalence | | ±5% | | FTIR w/spectral subtraction or partial least squares | 222-S |
| Flyash | Meet or Exceed ASTM C 618 | | | | ASTM C-618 | Vendor & 222-S |
| | and | | | | | |
| | Loss on Ignition (LOI) | | 1.0 | wt% | LE 519-108 | Vendor & 222-S |
| | Sulfur Trioxide ($SO_3$) | | 2.0 | wt% | XRF | Vendor & 222-S |
| | $SiO_2+Fe_2O_3+Al_2O_3$ | 70 | | wt% | XRF | Vendor & 222-S |
| | or | | | | | |
| | Equivalence | | ±5% | | FTIR w/spectral subtraction or partial least squares | 222-S |
| Attapulgite Clay | Meet or Exceed API Spec 13A, Sec. 5 | | | | API Spec 13A.5 | Vendor & 222-S |
| | or | | | | | |
| | Equivalence | | ±5% | | FTIR w/spectral subtraction or partial least squares | 222-S |
| Blast Furnace Slag | CaO, $SiO_2$ (Glass) | 90% | 100% | | XRF | Vendor & 222-S |
| | or | | | | | |
| | Equivalence | | ±5% | | FTIR w/spectral subtraction or partial least squares | 222-S |
| Dry Blend | Homogeneity | | ± 5% | wt% (Each Component) | FTIR w/spectral subtraction or partial least squares | 222-S |
| Fluidizer | Not Required | | | | | |
| Set Regulator | Not Required | | | | | |
| Decontamination Solution | TBD (TBD-WM-021) | | | | | 222-S |
| Caustic/ Nitrite Solution | OH | | | Molarity | LA-661-102, Potentiometric Titration | 222-S |
| | $NO_2$ | | | Molarity | LA-533-105, Dionex (Model 40001) | 222-S |

## Appendix 2. Analytical Requirements for GTF Samples

(continued)

| Material | Analysis | Min. | Max. | Unit | Analytical Method | Preferred Laboratory |
|---|---|---|---|---|---|---|
| Waste Feed | Partial List (See WHC-SD-WM-RD-019, Hendrickson, 1991 for complete list) | | | | | 222-S |
| (See WHC-SD-WM-RD-019 for complete list) | Total Organic Carbon (TOC) | | 1556 | ppm | LA-344-105, Combustion and Coulometry | " |
| | Ag | | 5063 | " | LA-505-151 (158) ICP | " |
| | As | | 0.15 | " | LA-355-131, AA | " |
| | Ba | | 46154 | " | LA-505-151 (158), ICP | " |
| | Cd | | 80 | " | " | " |
| | Cr | | 21000 | " | " | " |
| | Hg | | 20 | " | LA-325-102, AA | " |
| | Pb | | 12.5 | " | LA-505-151 (158), ICP | " |
| | Se | | 45 | " | LA-365-131, AA | " |
| | Al | | 20300 | " | LA-505-151 (158) ICP | " |
| | Na | | 122000 | " | " | " |
| | $NO_3$ | | 186000 | " | LA-533-105, Dionex (Model 40001) | " |
| | $NO_2$ | | 38250 | " | LA-533-105, Dionex (Model 40001) | " |
| | OH | | 34850 | " | LA-661-102, Potentiometric Titration (Automatic) | " |
| | H-3 | | 16 | μCi/L | LA,508-121, Liq. Scintillation Counting (LSC) | " |
| | C-14 | | 0.647 | Ci/L | LA-348-101, Distillation & LSC | " |
| | Co-60 | | 0.1162 | " | | " |
| | Sr-90 | | 0.2662 | " | | " |
| | Tc-99 | | 0.2617 | " | LA- 438-101, Solvent Extraction and LSC | " |
| | I-129 | | 0.00107 | " | LA-378-103, Solvent Extraction & GEA | " |
| | Cs-137 | | 0.3718 | " | LA-508-152, LA-548-122, GEA | " |
| | Total TRU (Np-237, Pu-238/239/240, Am-241, Cm-244) | | 100 | nCi/g | | " |
| | pH | 10 | | | LA-212-102 | " |
| | Heat Generators, Cs/mBa equivalents | | .37 | Ci/L | (Calculated) | " |
| | Specific Gravity | | 1.4 | | LA 519-151 | " |

## Appendix 2. Analytical Requirements for GTF Samples

(continued)

| Material | Analysis | Min. | Max. | Unit | Analytical Method | Preferred Laboratory |
|---|---|---|---|---|---|---|
| Grouted Waste Feed Samples | Pressure Drop | | 11.2 | psi | LA-519-174 | 222-S |
| | 10 Minute Gel Strength | | 100 | lbf/ 100ft$^2$ | LA-519-175 | " |
| | Critical Flowrate | | 60 | gal/min, 2" pipe | LA-519-174 | " |
| | Compressive Strength | 200 | | psi | LA 519-179 | " |
| | ANS 16.1 Leach Test, $NO_3$ | | 6 | Leach Index | LA-519-176 | " |
| | Excess Liquid | 0 | 0.5 | Vol% | ANS 16.1 | " |
| | TCLP Toxicity: Ag | | 5 | ppm | TCLP + ICP, SW-846 #6010, LA-505-151 (158) | " |
| | Ba | | 100 | " | " | " |
| | Cd | | 1 | " | " | " |
| | Cr | | 5 | " | " | " |
| | As | | 5 | " | TCLP + AA, SW-846 #7060, LA-355-131 | " |
| | Pb | | 5 | " | TCLP + ICP, SW-846 #6010, LA-505-151 (158) | " |
| | Hg | | 0.2 | " | TCLP + AA, SW-846 #7470, LA-325-102 | " |
| | Se | | 1 | " | TCLP + AA, SW-846 #7740, LA-365-131 | " |
| Non-Routine Sample | As Requested | | | | As Requested | As Requested |
| Grout Product | Compressive Strength | 200 | | psi | LA 519-179 | 222-S |
| | Excess Liquid | | 0.5 | vol% | LA-519-176 | " |
| | ANS 16.1 Leach Test | 6 | | | ANS 16.1 | " |
| | TCLP Toxicity: Ag | | 5 | ppm | TCLP + ICP, SW-846 #6010, LA-505-151 (158) | " |
| | Ba | | 100 | " | " | " |
| | Cd | | 1 | " | " | " |
| | Cr | | 5 | " | " | " |
| | As | | 5 | " | TCLP + AA, SW-846 #7060, LA-355-131 | " |
| | Pb | | 5 | " | TCLP + ICP, SW-846 #6010, LA-505-151 (158) | " |
| | Hg | | 0.2 | " | TCLP + AA, SW-846 #7470, LA-325-102 | " |
| | Se | | 1 | " | TCLP + AA, SW-846 #7740, LA-365-131 | " |

## Appendix 2. Analytical Requirements for GTF Samples

(continued)

| Material | Analysis | Min. | Max. | Unit | Analytical Method | Preferred Laboratory |
|---|---|---|---|---|---|---|
| Waste Liquid (LCT Liquid, Vault Leachate, Vault Excess Liquid) | Process Knowledge<br>**and/or** | N/A | N/A | | | |
| | Ba, Cd, Cr, Pb, Ag | | | | ICP, SW-846 #6010, LA-505-151 (158) | 222-S |
| | As | | | | AA, SW-846 #7060, LA-355-131 | " |
| | Hg | | | | AA, SW-846 #7470, LA-325-102 | " |
| | Se | | | | AA, SW-846 #7740, LA-365-131 | " |
| | $NO_2$ | .011 | 5.5 | Molarity | Dionex (Model 40001), LA-533-105 | " |
| | $NO_3$ | .010 | 5.0 | Molarity | " | " |
| | OH | | | | Potentiometric Titration, SW-846 #9040, LA-661-102 | " |
| | TOC | | | | Combustion & Coulometry, LA-344-105 | " |
| | Volatile Organic Analysis | | | | SW-846 #8240 | 222-S & PNL |
| | Differential Scanning Calorimeter | | | | LA-514-113 | 222-S |
| | Total Pu | | .013 | g/L | TIA Extraction & Alpha Counting, LA-943-101 | " |
| | Gamma Energy Analysis (GEA) | | | | LA 508-152, LA 548-122 | " |
| Radioactive Vapors | Beta/Gamma | ALARA | | Alarm | Record Filter, GEA, LA-508-052 | 222-S |
| | I-129 | ALARA | | Alarm | LA-288-101 (Silver Zeolite) | " |
| | Tritium/$H_2O$ Collector | ALARA | | Alarm | LA-218-112, Preparation of Silagel | " |
| | | | | | LA-508-121, Liquid Scintillation | " |
| Dust Emissions | (Visual) Dust | | 20% | Opacity | 40 CFR 60, App. A, Method 9 | |
| | Particulate Loading | | 0.1 | grains/ft$^3$ | 40 CFR 60, App. A, Method 5 | |
| Radioactive Equipment | Waste Classification | As Required | | | As Required | 222-S |
| Radioactive Wastes | Waste Classification | As Required | | | As Required | 222-S |

## Appendix 2. Analytical Requirements for GTF Samples

(continued)

| Material | Analysis | Min. | Max. | Unit | Analytical Method | Preferred Laboratory |
|---|---|---|---|---|---|---|
| Well Water | pH | N/A | N/A | (Measurement parameters will change based on previous analyses. See Section 4.33) | Field Measurement | Contract |
| | Specific Conductance | | | | " | |
| | Total Organic Carbon | | | | SW-846, #9060 | " |
| | Total Organic Halogens | | | | SW-846, #9020 | " |
| | Cl | | | | Ion Chromatography | " |
| | Fe | | | | ICP, SW-846, #6010 | " |
| | Mn | | | | " | " |
| | Phenols | | | | SW-846, #8040 | " |
| | Na | | | | ICP, SW-846, #6010 | " |
| | $SO_4$ | | | | Ion Chromatography | " |
| | TCLP Heavy Metals: Ag, Ba, Cd, Cr | | | | ICP, SW-846, #6010 | " |
| | As | | | | AAS, SW-846, #7060 | " |
| | Pb | | | | SW-846, #7470 | " |
| | Hg | | | | AAS, SW-846, #7740 | " |
| | Se | | | | AAS, SW-846, #7421 | " |
| | F | | | | Ion Chromatography | " |
| | $NO_3$ | | | | " | " |
| | Endrin | | | | SW-846, #8080 | " |
| | Lindane | | | | " | " |
| | Methoxychlor | | | | " | " |
| | Toxaphene | | | | " | " |
| | 2,4-D | | | | GC, SW-846, #8150 | " |
| | 2,4,5-TP Silvex | | | | " | " |
| | Radium | | | | SW-846, #9315 | " |
| | Gross Alpha | | | | SW-846, #9310 | " |
| | Gross Beta | | | | " | " |
| | Turbidity | | | | Field Measurement | " |
| | Coliform Bacteria | | | | SW-846, #9131 | " |
| | Tc-99 | | | | | PNL |

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